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ABSTRACT

This guide is intended to familiarize college students, enrolled in chemistry for the first time, with procedures that will contribute to successful completion of the course. The author describes why students should prepare in advance for lectures and laboratories, how to use the textbook and the study guide, and how to prepare for examinations. Justification for intensive study is given with a diagram of the general learning curve and a discussion of an individual's ability to recall over a period of time. A course outline and a list of materials, procedures, grading practices, and safety rules are given in the appendix. (SA)

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A GUIDE FOR STUDYING INTRODUCTORY CHEMISTRY

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by

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January 1980

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INTRODUCTION

An Introduction to College Chemistry (CH-1) is perhaps your first experience with chemistry or it may be a continuation of a study which began in high school. Whatever the case you should find the study of chemistry interesting and intellectually demanding. However, it should not be frightening.

Many students who did study chemistry prior to entering college perhaps remember many times when the subject seemed overwhelming. This need not be the case here. This guide was written in an attempt to provide students with a group of steps that should allow them to proceed logically through their study of the subject without becoming lost early in the course. No one need be rendered intellectually helpless by the course content.

The first step in your chemistry study should be to read this guide carefully. Second, you should refer to the guide from time-to-time as you proceed through your chemistry course.

PREREQUISITES

Assumptions have not been made about the students' chemistry backgrounds. This means the course will proceed as if it was your first chemistry course. However, certain assumptions have been made concerning students' mathematics backgrounds. It has been assumed that (1) when necessary, students will be able to solve linear and second-order algebraic equations, (2) students understand the concept or meaning of the slope of a line segment tangent to a point on a curve, and (3) students understand the concept of one.

Probably the element most critical to smooth progress through CH-1 is an understanding of the numberal "one". You will recall from your early studies in mathematics that one may be written in an infinite variety of forms:

$$\frac{1}{1}, \frac{2}{2}, \frac{3}{3}, \frac{4}{4}, \frac{5}{5}, \frac{A}{A}, \frac{B}{B}, \frac{AB}{AB}$$

are all forms of the numberal 1. By definition, then, one is any numeral that when written in its a/b form (for example 2/2) has a denominator that is contained in the numerator exactly one time.

Today, as in the past, the numberal 1 is used extensively in solving chemical problems. However, today the process is not called the use of one, but Dimensional Analysis. The title--Dimensional Analysis--has crept into the vocabulary because dimensions are included with the numerals. For example,

$$\frac{1m}{1.194\ yd.}, \frac{1.194\ yd.}{1m}, \frac{1cm^3}{1ml},$$

$$\frac{2.54cm}{1\ in.}, \frac{1ml}{1760\ yd.}$$

are all different forms of one.

TEXTS

Two texts and one manual are used during the conduct of CH-1. They are:

1. Brown, T.H., and LeMay, H.E. Chemistry: The Central Science. Englewood Cliffs, New Jersey: Prentice-Hall, Inc. 1977.

2. Hill, J.C. Student's Guide to Brown and LeMay Chemistry: The Central Science. Englewood Cliffs, New Jersey: Prentice-Hall, Inc. 1977.

3. Brown, T.L., and LeMay, H.E. Solutions to Exercises in Chemistry The Central Science. Englewood Cliffs, NJ: Prentice-Hall. 1977.

LECTURE PREPARATION

How students prepare for chemistry lectures may well determine not only amount their competencies increase as a result of taking the course, but also what their final grades will be. While the important feature of any study

is the extent to which one's competencies increase and not necessarily the final grade, our society still tends to place more weight on final grades than competencies. Therefore, students must constantly study methods which will accomplish both. In truth, the higher the final grades the easier it is for college graduates to find the employment they desire. The ability to demonstrate a high degree of competency after the employment has been secured will allow one to hold that employment.

Adequate lecture preparation may determine both the student's final grade and competency level. Appendix contains a course schedule. Reference to that schedule allows students to determine exactly where in their study they should be at any given moment. It may be assumed that the first class meeting each week will cover approximately fifty percent of the week's lecture material. Students should read the textual material to be covered in a lecture prior to attending the lecture. The old rule of thumb is that students should spend approximately one hour preparing for each one hour lecture. If you do this, you should find your lectures clear and continuous. Conversely, since lectures are designed to interpret textual material and not regurgitate the text, inadequate preparation may lead to failure.

CONDUCT DURING LECTURES

While lectures are in progress students should take clear and concise notes. It is not necessary to copy every word the lecturer says. Students will find they are better served later by a good outline of the lecture material. If a standard outline format is used for note taking:

I. Chemistry
  A. Molar Concept
    1. Avogadro's Number
      a. $6.0Z \times 10^{23}$
        (1) One gram

the gaps and details may easily be filled in at some later time. Remember, the

listening component is also an essential part of lecture participation. If all of your time is spent attempting to record each of the lecture's minute points you will probably miss hearing some important point or seeing some important visual detail.

STUDY FOLLOWING LECTURES

The prelecture study and the lecture outline should be united soon after the conclusion of a lecture. If you have done your work well, this should not take more than an hour. The final product should be a highly detailed and coherent set of notes.

Once prelecture study and lecture material have been dovetailed it is wise to solve problems which exemplify the important portions of the lecture subject. Each textbook chapter has problems included specifically for this purpose. Some problems in Brown and LeMay are numbered using blue, while others are numbered in black. Those problems numbered in blue have their answers included in Appendix F at the back of the textbook. Detailed solutions to the problems numbered in black may be found in publication 3 (above), Solutions to Problems in Brown and LeMay.

Next, the students must decide whether or not they really understand the material. The answer to this question is manifest in their facility with the end-of-chapter questions numbered in black. Students should solve these problems and check their solutions with the publication cited in the previous paragraph. If difficulty is experienced the matter should be discussed with lecture and laboratory instructors and then additional study conducted. In addition, students are advised that other authors may present the material differently than Brown and LeMay. Perhaps a point of misunderstanding clarified by consulting one of the many chemistry texts held by the college library.

Two to three hours of well-spent study for each hour of lecture gen-

erally will result in high course grades and a high degree of competency with the subject matter.

USING THE CLASS TEXT

Every text contains a wealth of information. Students who are aware of this are able to assimilate the course concepts with relative ease.

Whenever new courses commence students should read their entire text books at the very beginning. This is usually accomplished in several short steps, none of which require a disproportionate amount of the students' time. First, the table of contents and various chapter subtitles are read. This gives the reader an idea of the subjects that might be studied and how those subjects have been subdivided by the author.

The second step of the reading process requires thumbing through the text. In this phase it is necessary to take account of major chapter subheadings; how those subheadings have been subsequently subdivided; figures and diagrams; and, finally, what is included in the various Appendices and on the inside of each text cover. In the case of Chemistry: The Central Science a periodic table has been printed on the inside of the front cover and the back cover contains basic SI units, derived SI units and SI unit conversion factors.

Once readers have obtained an overview of the text individual chapters should be dissected. The most important section to read first is at the end of the chapter. Here, in the section titled "For Review", one finds a summary or an overview of material presented in the chapter. A list of learning goals for the chapter is also included in the review section. The learning goals provide an item-by-item description of the competencies students should be able to demonstrate after studying the chapter. These goals provide an advanced organization of the chapter. Later, after reading the chapter, students may test the competencies related to these goals by working through

the problems in the exercise section of the chapter.

The review section also contains a subsection titled, "Key Terms". The key terms presented in this section are highlighted in blue and then defined. These are the terms students should be able to define as a result of studying the chapter.

Returning to the beginning of a chapter, notice that it is divided into subsections. Each subsection heading reflects the concept being discussed in that subsection. Now, thumb through the chapter. Many key concepts presented in the context have been supported by figures, graphs, tables, pictures, and sample exercises. These aids are extremely important portions of each chapter. They present information which should allow the reader to visualize the concept under discussion and therefore should not be overlooked.

The actual reading of each chapter should be accomplished in two phases. As you know, each section begins with a topic paragraph. The first step is to proceed through a chapter, reading only the topic paragraphs. Once Step One is completed, readers should return to the beginning of the chapter and read all of the chapter in detail.

USING THE STUDENT'S GUIDE TO THE TEXT

There is a companion chapter in the student's guide for each chapter in the text. As Professor Hill points out in his introduction to the guide, the guide was written specifically to aid students in understanding the material presented by Brown and LeMay in the student text. Each chapter of the student guide presents an overview of its companion Brown and LeMay chapter, topic summaries and exercises, key terms, and a self-study quiz. Notice that each of the sample exercises has a solution immediately following it.

Professor Hill suggests that students read the chapter in the study guide prior to reading the chapter in Brown and LeMay, Chemistry, the Central

Science.

The study guide also contains Appendices extremely important to the study of general chemistry. Don't inadvertently pass them by.

PREPARATION FOR LECTURE (HOUR) EXAMINATIONS

Preparation for lecture examination should be a short process requiring perhaps not more than an hour per exam. In this study, students should briefly review their lecture notes, the learning goals sections of the chapters to be covered on the examination, the chapters in Professor Hill's study guide and laboratory activities that have been conducted since the last examination.

The basic purpose of an examination is to test the students' facilities (competency level) with the course material. This is accomplished by testing their abilities to meet the learning goals of the various chapters. If some rational study scheme (such as the one presented herein) has been followed they should be able to demonstrate a high level of competency on each examination.

STUDY FOLLOWING EXAMINATION

Examinations should be used as learning tools. After an examination has been returned, students should locate correct answers to items for which incorrect responses were provided on the examination. This allows testees to correct misconceptions which they might have about the subject matter. In addition, since most conceptualization is built upon previous background, correcting examination items provides individuals with a sound foundation upon which to build their future study of the subject.

PREPARATION FOR LABORATORY SESSIONS

Prior to attending a laboratory session the laboratory activity for the week should be read in detail. If portions of the activity are not understood, students should refer to relevant sections of the text and text study

guide before beginning the laboratory session.

CONDUCT DURING LABORATORY SESSIONS

Laboratory sessions are conducted essentially for the purpose of data gathering, data manipulation and technique development. Students (each activity is conducted with a partner) should discuss their observations amongst themselves as they work through laboratory exercises such a scheme facilitates understanding of the concepts with which the laboratory activities deal.

Completion of the laboratory activity sheets (at the end of the laboratory activity handout) is the logical conclusion of work upon an activity. The questions posed on these sheets help students obtain a better picture of how the activity is tied to the greater subject of general chemistry.

PREPARATION FOR LABORATORY EXAMINATIONS

The laboratory examinations have been designed to test student competencies with subjects investigated during laboratory sessions and laboratory techniques learned during the conduct of laboratory activities. Preparation for these examinations (there are two) should involve review of old lab reports. During the review particular attention should be paid to the results obtained from an activity and to the techniques used in obtaining the results.

PREPARATION FOR THE FINAL EXAMINATION

Since the final examination is the culmination of the entire course it can be expected to cover the entire course. Therefore, it is necessary to do a complete and thorough review prior to the examination. As with previous examinations, the learning goals sections of each of the chapters should be reviewed, only this time the review should include all text chapters covered in the course. In addition, laboratory activities and their results should be reviewed.

Although there is no acid test which will allow the students to predict

their outcome on the final examination, the purpose of the final should be considered. Recall that the purposes of the three hour examinations were to evaluate student competency levels over a certain block of material. Further, the competencies students were to develop as a result of studying a specific block of material were identified as learning goals at the end of each text chapter. From this it might be inferred that the task of the final examination reevaluate students' facilities or competencies with all of the course material. To some extent this inference is correct; however, for a moment consider the implications of learning curves to final examinations (see Figure 1).

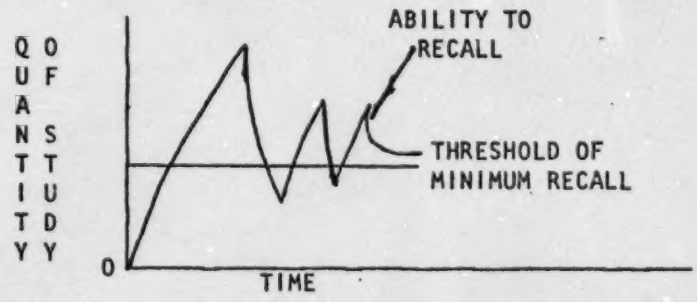

FIGURE 1. GENERAL LEARNING CURVE

The primary objective of a student's chemistry study is to gain knowledge and understanding of the subject which can be applied to real world situations. If it is impossible to recall (properly index the brain) the information when it is needed, then the study indeed has been a waste of time. In this regard, consider Figure 1. As study is begun at time zero an individual's ability to recall increases to some point above the threshold of minimum recall. Once study ceases, ability to recall drops and, if the initial quantity of study has not been sufficient, the ability to recall eventually falls below the minimum threshold of recall level. This first peak might be analogous to the initial study of a text chapter. When study is resumed the minimum threshold is again crossed and recall is more or less

immediate but, again, as the time after study increases the ability to recall decreases, but this time the curve does not proceed as far below the minimum recall level. The second peak might be related to an hour examination. Study again begins, perhaps this time for a final examination; however, this time notice that as time after study increases the ability to recall does not fall below the threshold of minimum recall. Idealistically then, in the end, the student should always be able to call upon chemical expertise when it is needed. However, when you attempt to apply this curve to your own situation you should proceed cautiously. The learning curve is a generalized one, yet each of us is an individual, therefore, one person may require more study sessions than another before his ability to recall remains above the minimum threshold level. Hopefully, you will have reached that point by final examination day.

Final examinations, like hour examinations, are not only tests of student competencies but also learning tools.

AN OVERVIEW OF THE CHEMISTRY LEARNING SCHEME

The learning scheme presented in these pages was developed specifically as a facilitator of chemistry learning. It is intended to provide students with a guide to logical progression through a three-hour chemistry course which meets twice each week for lecture and where students have one two-hour laboratory session each week. Figure 2 provides a block diagram of this scheme.

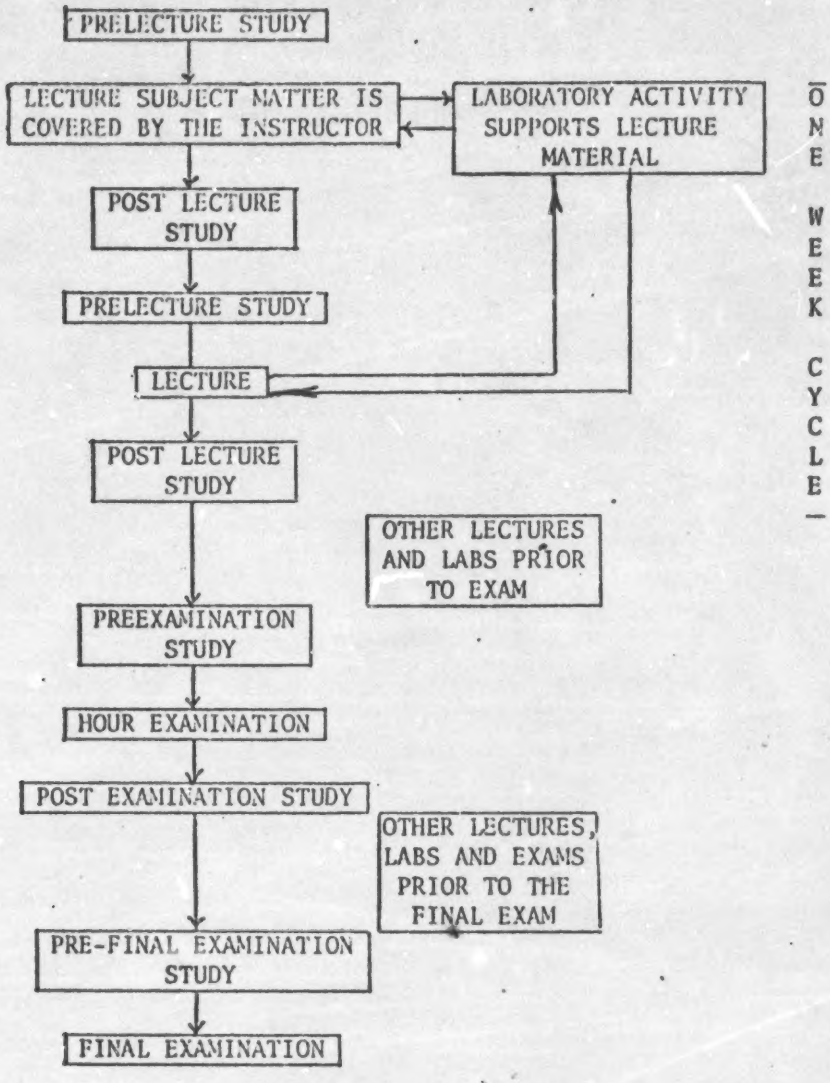

FIGURE 2. BASIC CHEMISTRY LEARNING SCHEME

In Figure 2 the arrows indicate the student's normal progress through the learning scheme.

The double (in two directions) arrows mean that the student attends a session other than a lecture and that the laboratory or recitation session functions to support that which has taken place in one or more (usually two) lectures.

APPENDIX A

COURSE OUTLINE

Maine Maritime Academy

Ch-1 GENERAL CHEMISTRY

Course Outline

Instructor: Prof. Schlenker Spring Semester 1980

MATERIALS

1. Brown, T.L., and LeMay, H.E. Chemistry: The Central Science. Englewood Cliffs, New Jersey: Prentice-Hall, Inc. 1977.

2. Hill, J.C. Student's Guide to Brown and LeMay Chemistry: The Englewood Cliffs, New Jersey: Prentice-Hall, Inc. 1977.

3. Brown, T. L., and LeMay, H.E. Sclutions to Exercises in Chemistry The Central Science. Englewood Cliffs, New Jersey: Prentice-Hall Inc. 1977.

COURSE COVERAGE

SEMESTER WEEK	DATES	TEXT CHAPTER	LABORATORY NUMBER
1	1 Jan.	1	1
2	7 Jan.	2	2
3	14 Jan.	3	3
4	21 Jan.	5	4
5	Lecture Exam 1-28 Jan.	6	5
6	4 Feb.	7	6
7	11 Feb.	8	Lab Exam
8	18 Feb.	9	7
9	Lecture Exam 2-25 Feb.	11	11
10	10 Mar.	12	13
11	17 Mar.	13	16
12	24 Mar.	14	14
13	31 Mar.	16	17
14	Lecture 4 Apr. Exam 3-10 Apr.	19	Lab Exam

COURSE GRADING

Lecture Exams	100 points each	300	FINAL GRADES: A - 720-800 points
Final Exam		200	B - 640-719 points
Lab Exams	60 points each	120	C - 560-639 points
Each Lab	15 points each	180	D - 480-560 points
	Total course pts.	800	

EXAMINATION TIMES

1. Lecture Examinations 1 & 2: Will be held on Monday evening of the week indicated above. They will take place at 7:00 p.m. in Dismukes Hall.

2. Lecture Examination 3: Will be held on Thursday evening of the week indicated above. The time and place will be the same as that of Examinations 1 & 2.

3. Laboratory Examinations 1 & 2: Will be held during the normal laboratory sessions on the weeks indicated.

4. Final Examination: Will be held during the regular finals week.

ATTENDANCE:

In order to receive any credit for a given laboratory session the student must be present for that session.

MAINE MARITIME ACADEMY

CH-1 GENERAL CHEMISTRY

LABORATORY INSTRUCTIONS

INSTRUCTORS: MESSRS. SCHLENKER AND BARLOW AND MRS. SMALL SPRING 1980

MATERIALS

Laboratory experiment handouts will be provided by your lab instructor.

PROCEDURES

1. Read and thoroughly study the lab experiment for the week prior to coming to the lab. Lab numbers and dates can be found on your course outline sheet.

2. Choose a lab station. There are eight stations and sixteen students. You will work with a partner and the partner you have for the first lab will remain your partner throughout the semester.

3. Conduct the lab activity for the week.

4. Complete and hand in the lab report sheet for the experiment within 24 hours after the completion of the lab period. Lab reports submitted more than 24 hours after a lab period will not be graded. These sheets are found at the back of the respective lab activities. You will be graded upon the answers you provide on these sheets. Credit will not be given for a lab unless you have participated in that lab.

LABORATORY GRADING

		TOTAL
Each laboratory	15 points	180
Laboratory examinations . .	60 points	120
Total		300

SAFETY

The following safety precautions are to be followed by all students whenever they are in the chemistry laboratory:

1. Aprons will be worn at all times.

2. Safety goggles or glasses will be worn at all times.

3. All chemicals will be assumed to be dangerous regardless of their colors or the labels on their containers.

4. The hood will be used whenever the experiment instructions specify.

5. At all times, students will follow the safety and work instructions listed on Pages 3--5 in the laboratory manual (these should be read before conducting the first laboratory experiment and repeatedly thereafter).